Abdominal Fat Quantification

The Fat Quantification script is a semi-automated tool that allows the outlining of Subcutaneous and IntraAbdominal contours for the purpose of determining the fat volume within those contours. The script although designed to handle both CT and MR images, has been primarily tested on CT data. Figure 1 is the GUI associated with Toolbox -> Volumetric-> Subcut/Intra-abdominal Fat Measurements.

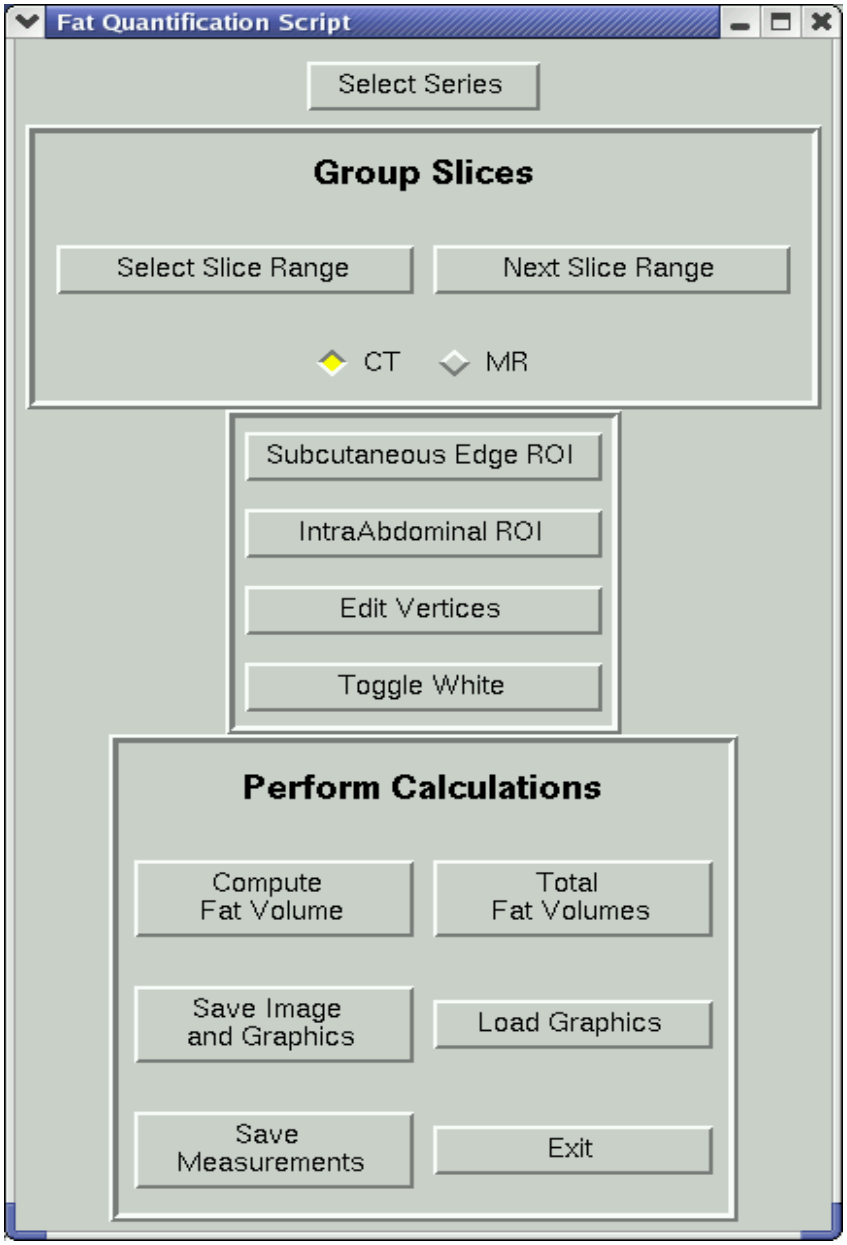

Figure 1. The GUI for the fat quantification script

Step 1: Press on **Select Series**. This should always be your first step. A New Folder will pop up with instructions to open an image. Specify an abdominal volume either through **Image ->DICOM->DICOM Manager** or from **Image->Open Image**. Then press on **OK** in the window that prompts you to "Please open an image".

Step 2: Press on the **Select Slice Range** button. To select the first slice, enter "0" for both **Enter lower slice number** and **Enter higher slice number**. Then press on **OK**. A 2D image of the selected slice will appear in the display area.

Step 3: Press on the **Subcutaneous Edge ROI** button. A script instruction box will appear asking you to drop a seed marker at the edge. This is required by the edge follower tool to follow the subcutaneous contour. Subsequent to dropping the marker, the contour is traced rather quickly and a confirmation box appears asking the user whether to discard or to keep the edge. Assuming that you are happy with the tracing. Press on **Keep Edge**. Then press on **Yes** in the instruction window.

Step 4: Press on the **IntraAbdominal ROI** button. The instructions are similar to Step 3 this time prompting you to drop a marker at the edge of the intraabdominal contour. Drop the marker. Let us suppose you are unhappy with the contour. Press on **Discard Edge** and then on **No** in the instruction window. Repeat the process until you are happy with intraabdominal contour tracing. If unsuccessful the first few times, you may have to go into *Pencil Mode* or the *Polygon Mode* to outline the contour.

Step 5: Let us assume that the intraabdominal contour needs small adjustments. Press on **Edit Vertices**. Red dots will appear on the intraabdominal contour. Press on the red dots to move them around to make adjustments. Once you are done, press on **OK** in the "Editing vertices" window.

Step 6: Now, press on **Toggle White**. A window will appear asking you if you are happy with the fat depiction. Assuming you are not, press on **No**. Another small window appears prompting for the thresholds. The proper thresholds can be determined by going into pixel surfing mode (press on the icon right below Page) to determine the fat intensity range. Enter the new **Low threshold** and **High threshold** and press on **Toggle White**. Repeat the procedure until you are happy with the fat depiction. At that point first press on **Yes;** then on **Toggle White**.

Step 7: Proceed with **Perform Calculations**. Press on **Compute Fat Volume**. In the window you are running MEDx from, the computation results will appear across sub_area and abdom_area with the difference assigned to Subcut. The program internally keeps track of these numbers. No need for you to worry.

Step 8: Proceed onto processing another slice. Press on **Next Slice Range**. Then repeat Steps 3 to 7.

Step 9: Now suppose that you want to reprocess slice 1. Press on **Select Slice Range**. You will see 1's for the lower and higher slice numbers. Press on **OK**. In the display area, you should see slice 1 with the contours removed.

Step 10: Go back to **Select Slice Range**. Enter *100* for the lower and higher slice numbers. Press on OK. You should get a message informing that "You have selected an upper slice above the slice range".

Step 11: Go back to **Select Slice Range**. Specify any slice you want to process and press on **OK**. Then repeat steps 3 to 7.

Step 12: Now that you have computed the fat volume for a number of slices, proceed with the **Total Fat Volumes** option. A window will appear listing the slices for which the fat volumes exist. To exclude a specific slice from the total fat volume, highlight the slice and press on **Remove**. Then press on **OK**. The slice **Volume Measurements** and the **Total Volume(cc)** will appear in a table on your screen.

Step 13: The volume measurements are also saved in the /tmp directory in a file with name *patname_date.txt*. You can open an xterm, go to /tmp i.e. cd /tmp and type the command "cat *patname_date.txt*" to verify the contents of the file.